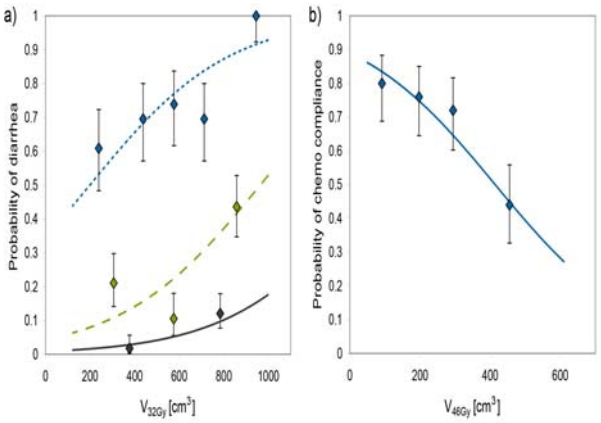

Figure 1
a) Relationship between absolute volume of the intestinal cavity receiving 32 Gy or above and the probability of acute diarrhea. Dotted line: Risk of CTCAE grade 1 or above diarrhea. Dashed lined: Risk of grade 2 or above diarrhea. Solid line: Risk of grade 3 diarrhea.
b) Relationship between absolute volume of intestinal cavity receiving 46 Gy and above and the probability of completing chemotherapy without interruptions, dose reductions or discontinuation.
For both figures: Data points, with 68% confidence intervals, plotted as illustration of model fit.

Conclusions: We found that dose to the intestinal cavity (V_{32Gy} and V_{46Gy}) was associated with acute diarrhea and chemotherapy treatment compliance in patients treated with IMRT for primary rectal cancer. The results are not in direct agreement with results from patient cohorts treated with 3D-CRT, where V_{15Gy} has consistently been reported as an optimal dose cut-off.

PO-0910

Local control prediction for NSCLC using a common LQ-based TCP model for both SABR and 3D-CRT fractionation

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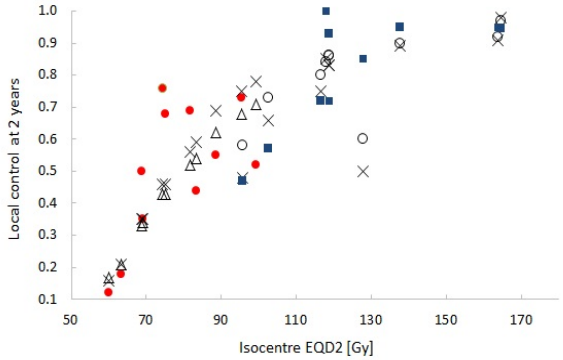
Purpose/Objective: Opinion in the literature is divided as to whether the LQ model of cell kill, and consequently TCP models based on it, are applicable for the relatively high dose per fraction delivered during SABR treatments of NSCLC. This work aimed to establish whether LQ-based TCP modelling can adequately describe observed local control in NSCLC radiotherapy for both 3D-CRT and SABR deliveries, through fitting model parameters to reported outcomes for both techniques.

Materials and Methods: Two patient cohorts, each comprising approximately 25 clinical PTV DVHs, were constructed from retrospective clinical data for mixed-stage 3D-CRT and stage I SABR treatments. Cohorts differed in GTV sizes (averaging 106 cm^3 for 3D-CRT and 15 cm^3 for SABR) and dose variation due to the lower isodose level (67 to 80% of isocentre dose) covering the PTV for SABR. An LQ-based TCP model was used to predict local control for individual PTV DVHs, which were then averaged over each cohort to estimate local control for that population. Fixed parameters were clonogen density within the GTV (1e7 cm^{-3}), alpha-beta ratio (10 Gy), time to the onset of accelerated repopulation, T_k (21 days) and doubling time, T_d (3.7 days). Free parameters fitted to published outcome data were mean radiosensitivity, α, and standard deviation σ_α. Parameters were fitted to reported local control at 2 years for a range of dose/fractionation schedules using maximum likelihood estimation. Best fit parameters were derived for combined 3D-CRT and SABR outcome data and for each technique separately. Uncertainty estimates on derived parameter values were derived from likelihood profiles to assess the significance of parameter set differences.

Results: Best-fit TCP model parameters (and 95% confidence intervals) for combined 3D-CRT and SABR cohorts were α = 0.293 (0.286 to 0.302) Gy^{-1} and σ_α = 0.051 (0.042 to 0.067). Best-fit parameters resulting from separate fitting to only 3D-CRT data fell within the 95% confidence limits of these values. For SABR-only fitting, α (only) fell outside this confidence interval; α = 0.313, σ_α = 0.06, however the 95% confidence interval on SABR-derived α (0.292 to 0.342) encompassed the fit to combined data. Resulting local control estimates are compared with the literature in the figure below, along with the predictions for separate model fitting to 3D-CRT and to SABR data. Repopulation-corrected equivalent 2Gy dose (EQD2) to the isocentre is used as the metric, indicating a smooth transition from 3D-CRT to SABR techniques.



Comparison of TCP model prediction with local control at 2 years reported in the literature. Published 3D-CRT for mixed-stage disease (●), published stage I SABR (■), parameter fit to combined 3D-CRT and SABR data (x), 3D-CRT only model (Δ), SABR only model (○).

Conclusions: An LQ-based TCP model was found to adequately reproduce reported 2-year local control for both 3D-CRT and SABR NSCLC techniques. Further, a common parameter set (α, σ_α) was found to be consistent with data for both techniques, despite the large dose and GTV size differences between patient cohorts. No significant advantage was found in fitting parameters to each technique separately.

PO-0911

Method to estimate tumour response in boost scenarios based on clinical data

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